PATENT SPECIFICATION

DRAWINGS ATTACHED

1,042,732

1,042,732

Date of Application and filing Complete Specification: Feb. 27, 1963.

No. 7890/63.

Complete Specification Published: Sept. 14, 1966.

Index at Acceptance:—B5 A(1G2, 1G3B, 1G7A1, 1G10, 1U3A, 2A3); B5 N(1B1, 2G, 2N3, 2N6, 11K1, 13, 16B3)

Int. Cl.:—B 29 d//B 32 b

COMPLETE SPECIFICATION

Improvements in and relating to Synthetic Resin Articles

CORRECTION OF CLERICAL ERROR

SPECIFICATION NO. 1,042,732

The following correction is in accordance with the Decision of the Assistant Comptroller, acting for the Comptroller-General dated the 29th day of December, 1966.

Page 1, line 1, *after* "National," *insert* "of Section 47-102, No. 8, Edakawa-cho, Nishinomiya-shi, Hyogo-ken, Japan formerly".

THE PATENT OFFICE,
12th April, 1967

D 83865/14

thetic resin cellular material is bonded at both sides to facings of sheet synthetic resin so as to form a board having a multi-ply construction. However, the process for the production of such a multi-ply board is complicated and expensive, and, furthermore, such a construction has the disadvantage that the core structure tends to separate from the sheets forming the facings of the board. Also one-piece synthetic resin boards have been produced by a rolling process in which molten synthetic resin is forced between a plurality of cooled rolls thereby being cooled and set, or by an extrusion process in which molten synthetic resin is extruded from an extruding die device and is placed in contact with the surface of a stationary metallic plate, thereby being cooled and set, or alternatively, a sheet of heat-softened synthetic resin material is cooled by jets of cool water or air to a predetermined temperature and thereby set. However, for the production of synthetic resin board having an internal cellular construction as hereinafter described, any of the known processes may not be altogether satisfactory because the boards tend to be

[*Price*

prises a die head and a core disposed within said die head and divided into a plurality of mandrels corresponding in shape to the shape of the cells of the board to be extruded, air or a filler material being supplied to the cells during such extrusion, and wherein the pressure of the air or filler material supplied to the cells is regulated and at least one surface of the extruded board is engaged by a shaping and cooling surface to determine the internal cell configuration and the outer surface shape of the board.

The invention includes apparatus for producing a synthetic resin board comprising an extrusion head containing an extrusion chamber and provided with an extrusion orifice and a material inlet connected to the extrusion chamber, a core in said extrusion head, said core being divided into a plurality of mandrels at said extrusion orifice, said mandrels being spaced from one another and from the walls of the extrusion orifice to form cells in the board separated by longitudinal partition walls, each mandrel having a passage for the supply of air of filler material to the cells and a cooling and setting

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Int. Cl.:—B 29 d//B 32 b

COMPLETE SPECIFICATION

Improvements in and relating to Synthetic Resin Articles

We, YUZO KAWAMURA, a Japanese National, of 1826—26, Kosone, Toyonaka-shi, Osaka-fu, Japan, and TOKAN KOGYO COMPANY LIMITED, a Japanese Company, of Section 32, No. 11, 3-chome, Ikejiri, Setagaya-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to the production of synthetic resin board by extrusion and to the product board.

For light weight board a so-called sandwich type construction has been employed in which a core structure such as paper honeycomb, synthetic resin honeycomb or synthetic resin cellular material is bonded at both sides to facings of sheet synthetic resin so as to form a board having a multi-ply construction. However, the process for the production of such a multi-ply board is complicated and expensive, and, furthermore, such a construction has the disadvantage that the core structure tends to separate from the sheets forming the facings of the board. Also one-piece synthetic resin boards have been produced by a rolling process in which molten synthetic resin is forced between a plurality of cooled rolls thereby being cooled and set, or by an extrusion process in which molten synthetic resin is extruded from an extruding die device and is placed in contact with the surface of a stationary metallic plate, thereby being cooled and set, or alternatively, a sheet of heat-softened synthetic resin material is cooled by jets of cool water or air to a predetermined temperature and thereby set. However, for the production of synthetic resin board having an internal cellular construction as hereinafter described, any of the known processes may not be altogether satisfactory because the boards tend to be easily deformed in handling and the extruded board has very low heat conductivity and the result is a low rate of cooling, especially at the interior of the board so that the rate of contraction between various parts of the board differ greatly with the result that, in the cooling-plasticizing stage, variations may occur in the thickness of the outer facings of the board thereby making it impossible to maintain the desired shape and dimensions in the finished article.

Accordingly the present invention comprises a process for continuously producing a synthetic resin board having a predetermined cross sectional configuration of cells wherein the synthetic resin is heated and extruded through an extrusion die device which comprises a die head and a core disposed within said die head and divided into a plurality of mandrels corresponding in shape to the shape of the cells of the board to be extruded, air or a filler material being supplied to the cells during such extrusion, and wherein the pressure of the air or filler material supplied to the cells is regulated and at least one surface of the extruded board is engaged by a shaping and cooling surface to determine the internal cell configuration and the outer surface shape of the board.

The invention includes apparatus for producing a synthetic resin board comprising an extrusion head containing an extrusion chamber and provided with an extrusion orifice and a material inlet connected to the extrusion chamber, a core in said extrusion head, said core being divided into a plurality of mandrels at said extrusion orifice, said mandrels being spaced from one another and from the walls of the extrusion orifice to form cells in the board separated by longitudinal partition walls, each mandrel having a passage for the supply of air of filler material to the cells and a cooling and setting

[*Price*

device having faces by which it is adapted to engage the opposite facings of the extruded board for cooling the board at a thickness determined by the distance between the faces of said cooling and setting device.

The invention is further described, by way of example, with reference to the accompanying drawings in which:—

Figs. 1 to 5 are sectional views of parts of several embodiments of synthetic resin board made by the process of the present invention;

Fig. 6 is a detail perspective view of the board shown in Fig. 1;

Figs. 7 and 8 are longitudinal sections of the board made by processes according to two further embodiments of the invention;

Fig. 9 is a detail perspective view of a board made by yet another embodiment of process according to the invention;

Fig. 10 is a diagrammatic sectional elevation of an extruding machine constructed in accordance with the present invention;

Fig. 11 is a front elevation of the die device of the machine of Fig. 10, viewed on the line X—X;

Fig. 12 is a perspective view of the core divided into mandrels and constituting part of the extruding machine shown in Figs. 10 and 11;

Fig. 13 is a vertical sectional view of a setting shaping device to be employed in conjunction with the extrusion head of the extruding machine shown in Figs. 10 and 11;

Fig. 14 is a vertical sectional view of another embodiment of setting shaping device which also serves to prevent the shrinking of the board while it is being cooled and which is to be employed in conjunction with a modified extruding machine of the present invention;

Fig. 15 is a cross sectional view of a product made by the setting shaping device shown in Fig. 14;

Fig. 16 is an axial section of part of a further modified extruding machine which machine is especially suitable for manufacturing a cylindriform board;

Fig. 17 is an end elevational view of the part shown in Fig. 16; and

Fig. 18 is a perspective view of the extruding machine whose part is shown in Figs. 16 and 17.

Referring now to Figs. 1 to 4 and Fig. 6 of the accompanying drawings, numeral 1 designates both facings of four embodiments of synthetic resin board extruded by the process of the present invention. The facings 1 are formed integrally with longitudinal partition walls 2 provided therebetween so as to define a plurality of cells 3 therebetween. The cells 3 are open at both ends of the board and their configuration may be varied by changing the contour or disposition of the partition walls 2.

Figs. 7, 8 and 9 show boards which have been made by modifying the extrusion process of the invention. In Fig. 7, transverse partion walls 5 extend between the partition walls 2 and divide the interior of the board into separate closed cells 6. In Fig. 8, internal ribs or protrusions 7 extend transversely between the partition walls 2 and strengthen and impart resilience to the board. In the board of Fig. 9, the separate air cells shown in Fig. 7 are reduced in size so as to present a spherical cellular appearance. In the board of Fig. 5, the cells mentioned above with respect to the core of Figs. 1 and 6 are filled with either solid or expanded filler of an organic or inorganic substance. However, such filler is equally applicable to boards having cross sectional forms other than that of Figs. 1 and 5.

In Figs. 10 to 12, one embodiment of an extrusion machine suitable for the production of synthetic resin board by a process in accordance with the present invention is shown. As seen from these Figs., the machine comprises an extrusion head 10 provided with a rectangular extrusion orifice 14, a material inlet 11 disposed at the rear of the extrusion head for receiving molten synthetic resin material and an extrusion chamber 13 communicating with the inlet and with the outlet and defined by a tapered bore 12 of the head 10. Adjusting means 14*a* are disposed midway between the outlet 14 and the extrusion chamber 13 for adjusting the width of the spaces A defined between the inner surfaces of the adjusting means 14*a* and a core 17 (to be described hereinafter). Control plates 15 are provided in the front of the head for controlling the passage width at the outlet side of the head. As illustrated in Fig. 12, the front end of the core 17 is divided by slots 28 into a plurality of mandrels whose cross section corresponds to the desired cross section of the cells of the extruded board. The cross section illustrated is suitable for producing the board of Fig. 2. Each mandrel has a longitudinal air passage 20 and these passages 20 communicate with a common air inlet pipe 19. The pipe 19 is connected to a suitable external source of air under pressure. In Fig. 10, the core 17 is shown as being supported by a lug 18.

A pair of opposed endless metallic belts 22 is disposed beyond the head 10 and are supported by rotatable rollers 21. The endless belts are driven in the direction of extrusion by the rollers 21 and are perforated with a number of small holes. The rotatable rollers 21 are adjustable in position. A pair of opposed suction chambers is provided, one at the inner face of each endless belt 22. The suction chambers 26 contain cooling rollers 23 which are themselves cooled by air or water. Air is extruded from the suction chambers 26 through outlets 25. If desired

only one of the belts 22 and its associated suction chamber can be operated, the other belt and suction chamber standing idle together with its cooling rollers 23 or running freely. The drive mechanism (not shown) for the endless belts 22 may be such that the belts can be driven at a predetermined constant speed or intermittently in a regular periodic manner. In Fig. 10, numeral 27 designates guide rolls for advancing the formed board to a predetermined picking up station.

In the operation of the machine of Figs. 10 to 12, heated synthetic resin in a suitable state of fluidity is supplied under pressure through the inlet 11 into the extrusion chamber 13 where it is divided into two streams, upper and lower, by the lug 18, but converges into a single body as the streams leave the chamber 13 and then simultaneously pass through the spaces A to form the facings 1 and through the inclined slots 28 to form the partition walls 2 of the board being thereby extruded. During such extrusion, air under a predetermined pressure is supplied at a suitable rate to the individual cells 3 by way of the respective air passages 20 of the mandrels to prevent the extruded board from collapsing. Suction applied to the suction chambers 26 causes the facings of the board to be drawn against the endless belts 22 and carried by the belts at a constant velocity. The thickness of the board is predetermined by the spacing between the belts 22. As the board is being moved in this way, it is cooled by cooling rollers 23 and stabilized at the desired thickness. Extruded board having cells 3 of the shape shown in Fig. 2 is thereby obtained. The extruded board is then advanced to a predetermined picking up station by the guide rolls 27 and cut into desired lengths for use. The overall thickness of the board can be changed by varying the distance between the pair of endless belts 22 and the rate of supply of air to the cells without changing the core 17 or the size of the orifice 14. By heating the two rotatable rollers 21 adjacent to the extrusion orifice 14 to a suitable temperature subsequent deformation of the extruded board can be further controlled thus assisting in the stabilization of its dimensions.

The core 17 can be replaced by other cores whose mandrels are of different cross sections to obtain boards with cells of different configuration. For example, the mandrels can be square or round to obtain the board shown in Fig. 1 or Fig. 3.

In the operation mentioned above, if the travelling movement of the opposed pair of endless belts 22 is intermittently stopped at predetermined intervals or the rate of picking-up of the product therefrom is reduced, internal transverse partitions 9 (Fig. 7) or knob like projections 7 (Fig. 8) may be obtained as the board is extruded, since the travel of the board is interrupted but not the rate of extrusion. The synthetic resin board having the separate air cells 6 as shown in Fig. 7 has great resilience. In addition, by injecting air at low pressure in spurts through the passages 20, a synthetic resin board having the cellular configuration shown in Fig. 9 can be obtained. Furthermore if one of the two endless belts 22 is removed and the air pressure is sufficient to somewhat dilate the cells, a board having a cobbled surface as shown in Fig. 4 can be obtained. By supplying a suitable filler material through the air passages 20 into the cells 3 in place of air, a synthetic resin board having filled cells shown in Fig. 5 may be obtained.

In the modified embodiment of extrusion machine shown in Fig. 13, a stationary cooling shaping device 29 is provided in place of the cooling shaping device comprising the endless belts 22, cooling rollers 23 and suction chambers 26. The board which has been extruded through the spaces A of the extrusion head 10 (which is the same as that of Fig. 10) is frictionally guided into contact with the contacting surfaces of the cooling shaping device 29. The device 29 can be adjusted to vary the distance between these contacting surfaces. Exhaust pipes 32 extend across cooling chambers 33 of the cooling shaping device 29 from air passages 30 connected to suction bores 31 of the cooling shaping device 29 to generate suction that pulls both facings of the board into contact with the respective surfaces of the cooling shaping device so that the board is frictionally guided in contact with the contacting surfaces. As the board is moved along, the article is cooled by cooling air or water whose temperature is controlled and which is supplied to the cooling chambers 33 so that the board may be set in its predetermined dimension. In the extrusion machine of Fig. 13, the cooling shaping device 29 is divided into two parts. The fore-part 29*a* is maintained at a temperature suitable to effectively cool the facings 1 of the extruded board while the rear-part 29*b* is maintained at a temperature suitable to effectively cool the partition walls 2. The cooling shaping device may be divided into more than two parts, if desired, so that the facings and the partition walls of the board may be cooled at varying cooling rates. Furthermore, the above contacting surfaces of the cooling shaping device may be subjected to shot-peening or provided with a surface having small pits similar to those produced by shot-peening.

In the embodiment of extrusion machine of Fig. 13, the extruded synthetic resin board is led away in direct contact with metallic endless belts 27, but if a layer of cloth, paper or synthetic resin is to be applied to the surface of the extruded board, such a finish-

ing layer is inserted between a metallic endless belt 27 and the synthetic resin board along the longitudinal direction of the belt.

The further modified embodiment of extrusion machine of Figs. 14 and 15 comprises an extrusion die having a pair of cores 17 which is adapted to extrude two synthetic resin boards 45 joined at their lateral edges by excess material portions 45 which serve to prevent lateral shrinkage of the boards during cooling. The front cooling shaping and rear cooling shaping devices comprise a pair of outer cooling means 34, 40 respectively, and the positions of these coling means can be adjusted relative to their corresponding intermediate cooling means 37, 43, respectively. The front cooling shaping devices 34, 37 are provided with respective air passages 35, 38 to permit cooling air to pass through the cooling shaping devices. Air pipes 36, 39 connected to an external source (not shown) of cooling air communicate with the respective air passages 35, 38. The rear cooling shaping devices 40, 43 are provided with cooling water passages 41, 44 respectively which communicate with external cooling water sources. When the extruded boards pass through the cooling shaping devices in the direction indicated by the arrows B while cooling air is directed thereon at a suitable rate both facings 1 of the synthetic resin board are cooled and set by the front cooling shaping devices and at the same time the excess material portions 46 (Fig. 15) are also cooled and solidified, and the inner surfaces of said facings are restricted by the opposing sides of the intermediately disposed cooling device 37. The partition walls 2 of the synthetic resin boards 45 are cooled and set by the water-cooled rear cooling shaping device as the already solidified excess portions 46 prevent the boards 45 from lateral shrinkage or deformation. The thus treated board is advanced toward a predetermined pick-up station by the rollers 27 where the excess material 46 is cut-off by any suitable means.

Figs. 16 and 17 show an extrusion die device suitable for the extrusion of cylindriform resin board. This extrusion die device comprises a cylindrical extrusion head 47 having an outer extrusion outlet 51, an insert disc 49 having an inner extrusion outlet 50 and an annular core 48 divided into a plurality of mandrels by slots 59 as explained with reference to Figs. 10, 11 and 12. The cross section of the mandrels corresponds to the desired cross section of the cells of the cylindriform board. The core 48 is arranged between the head 47 and the disc 49 so that annular spaces A remain therebetween as well as extrusion chambers 52 and 53. The head 47, the core 48 and the disc 49 are firmly held in position by air pipes 55 extending through these components and having centre bores 54 extending therethrough. The annular core 48 is provided with a number of air passages 56 through which air is supplied to the cells of the cylindriform board for forming the cellular structure. The number of air passages 56 corresponds to that of the cells to be formed between the outer and inner facings of the cylindriform board. Air is supplied to the passages 56 by the air pipes 55 from an air supply pipe (not shown). When molten synthetic resin material is supplied from a separate extrusion machine through the inlet 57, a portion of molten resin material flows to the extrusion chamber 52 and the remainder passes through the centre bore of the annular core 48 into the chamber 53 to fill the spaces A and the slots 59 and is then extruded out of the die device as a continuous cylindriform board having cells 3 formed between its outer and inner facings. The die device is employed in conjunction with a cooling shaping device generally indicated by numeral 60 in Fig. 18. As shown in Fig. 18, the cooling shaping device 60 is supported on the extrusion head by stays 62 and comprises a plurality of nozzles 61 which are supplied with cooling air through a cooling air pipe 63 from an external air source whereby the cylindriform board may be shaped to the diameter corresponding to that of the device 60. The pressure of the air forced into the interior of the cylindriform board between the device 60 and the head 47 through the nozzles 61 inflates the cylindriform board against the tendency thereof to shrink, thereby defining the diameter of the cylindriform board by the device 60. At the same time, air blown out to atmosphere through the clearance between the cylindriform board and the device 60 effects cooling of the cylindriform board. Immediately after having been extruded from the die device, if the cylindriform synthetic resin board is axially cut open by means of a cutting device 64 and the cut board is cooled and set in a desired form, for instance, in a flat form, a flat synthetic resin board having two flat facings or one flat facing as mentioned above in connection with Figs. 1 to 8 may be obtained as well as a cylindrically shaped article.

In the embodiment shown in Figs. 16, 17 and 18, as in the embodiment of Fig. 10, the core 48 may be supplied intermittently with air through its passages 56 to form cylindriform boards having the cross sectional configurations shown in Figs. 3, 7, 8 and 9.

Although the extrusion devices illustrated are horizontally arranged, a vertical arrangement is possible.

WHAT WE CLAIM IS:—

1. A process for continuously producing a synthetic resin board having a predetermined cross sectional configuration of cells wherein the synthetic resin is heated and extruded through an extrusion die device which com-

prises a die head and a core disposed within said die head and divided into a plurality of mandrels corresponding in shape to the shape of the cells of the board to be extruded, air or a filler material being supplied to the cells during such extrusion, and wherein the pressure of the air or filler material supplied to the cells is regulated and at least one surface of the extruded board is engaged by a shaping and cooling surface to determine the internal cell configuration and the outer surface shape of the board.

2. A process as claimed in claim 1 in which the movement of the extruded board away from the die head is intermittently interrupted or varied whilst the rate of extrusion is unchanged in order to provide internal transverse partitions or ribs in the board before the cooling is complete.

3. A process as claimed in claim 1 or 2, in which the extruded board is transported from the die device by a pair of opposed endless metallic perforated belts and suction is applied to the perforations to cause the facings of the extruded board to adhere to the belts during cooling, the thickness of the finished board being determined by the distance between the belts.

4. A process as claimed in claim 1 or 2, in which the extruded board is transported from the die device by an endless metallic perforated belt and suction is applied to the perforations to cause one facing of the extruded board to adhere to the belt during cooling whilst the other facing remains exposed so that only one face of the finished board is flat.

5. A process as claimed in claim 1, in which the board extruded from the die device is caused to pass between a pair of opposed, air or water cooled metallic cooling setting devices whose opposed faces have a plurality of suction holes for drawing the facings of the board against opposed faces whilst the extruded board is cooled, the thickness of the finished board being determined by the distance between said opposed faces of the cooling/setting device.

6. A process as claimed in claim 1 in which the extruded board is transported from the extrusion die device by a metallic cooling setting device having a face with a plurality of suction holes for drawing one facing of the board against said face during cooling to maintain that facing flat whilst the other facing of the board remains exposed.

7. A process as claimed in claim 1, in which two parallel synthetic resin boards are extruded simultaneously with excess material portions which interconnect the lateral edges of the boards, and one of the extruded boards is caused to pass between a first metallic cooling body and an air cooled intermediate metallic cooling body and the other board is caused to pass between said intermediate cooling body and a second metallic cooling body, said first and second cooling bodies being cooled by air or water, and the extruded boards are cooled and set by the cooling bodies while said excess material portions prevent lateral shrinkage of the boards and thereafter said excess material portions are cut off.

8. A process as claimed in claim 1 in which the board is extruded in a cylindrical shape.

9. A process as claimed in claim 8 in which the cylindriform board is cut longitudinally and flattened out before cooling is completed.

10. A process as claimed in claim 1, 2 or 8 in which air is supplied intermittently to said cells.

11. A process as claimed in claim 1, 2, 3, 5 or 6 in which a member such as cloth, paper or synthetic resin material which is different from that of the extruded board is applied between a metallic endless belt and the extruded board and laid on the surface of the board while the board is moved along by said metallic endless belt.

12. Apparatus for producing a synthetic resin board comprising an extrusion head containing an extrusion chamber and provided with an extrusion orifice and a material inlet connected to the extrusion chamber, a core in said extrusion head, said core being divided into a plurality of mandrels at said extrusion orifice, said mandrels being spaced from one another and from the walls of the extrusion orifice to form cells in the board separated by longitudinal partition walls, each mandrel having a passage for the supply of air or filler material to the cells and a cooling and setting device having faces by which it is adapted to engage the opposite facings of the extruded board for cooling the board at a thickness determined by the distance between the faces of said cooling and setting device.

13. Apparatus as claimed in claim 12 in which adjusting means are disposed between the extrusion orifice and the extrusion chamber for adjusting the magnitude of the spaces between the mandrels and the orifice wall and control plates provided at the front of said head for controlling the width at the outlet end of said spaces.

14. Apparatus as claimed in claim 12 or 13 in which the cooling and setting device comprises a pair of perforated endless metallic belts, rollers for driving said belts and opposed suction chambers for applying suction to the perforations.

15. Apparatus as claimed in claim 12 in which a pair of cores is disposed in parallel relation to each other within said head, each being divided into a plurality of mandrels at said orifice and in which the cooling and setting device comprises front cooling and rear cooling devices, a plurality of air passages

provided in said front cooling and rear cooling devices, air supply pipes communicating with said air passages, each of said front and rear cooling devices comprising a pair of outer cooling members and an intermediate cooling member and the position of said outer cooling members being adjustable relative to said intermediate cooling members.

16. Apparatus as claimed in claim 12 in which the extrusion head is cylindrical and has an outer extrusion wall and an insert disc having an inner extrusion wall and the core is annular and its mandrels are disposed in the annular space between said extrusion walls.

17. Apparatus as claimed in any of claims 12 to 15 in which the cooling and setting device is adjustable to vary the distance between said faces thereof.

18. Process for continuously producing synthetic resin boards substantially as hereinbefore described with reference to the accompanying drawings.

19. Apparatus for producing a synthetic resin board substantially as hereinbefore described with reference to and as illustrated in Figs. 10 to 13 of the accompanying drawings.

20. Apparatus for producing a synthetic resin board substantially as hereinbefore described with reference to and as illustrated in Fig. 14 of the accompanying drawings.

21. Apparatus for producing a synthetic resin board substantially as hereinbefore described with reference to and as illustrated in Figs. 16 to 18 of the accompanying drawings.

22. A synthetic resin board when produced by the process claimed in any of claims 1 to 11.

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Chartered Patent Agents.

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Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

Fig. 1

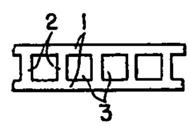

Fig. 2

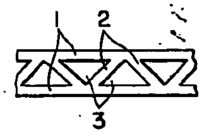

Fig. 3

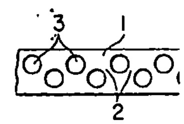

Fig. 4

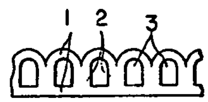

Fig. 5

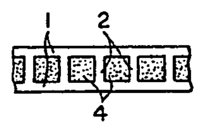

Fig. 6

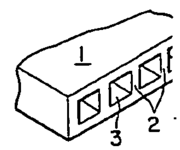

Fig. 7

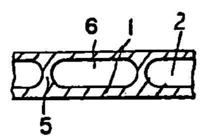

Fig. 8

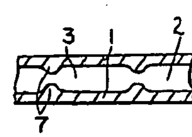

Fig. 9

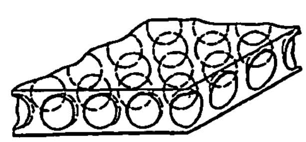

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Fig. 3

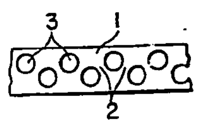


Fig. 10

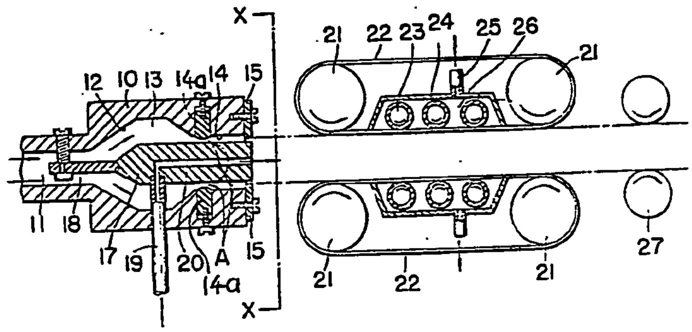


Fig. 6

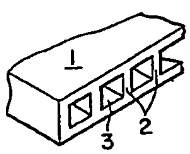
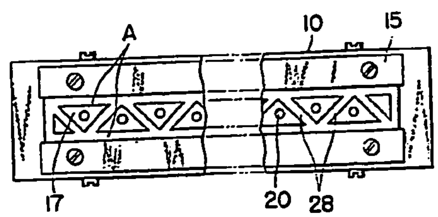


Fig. 11



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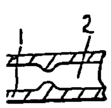
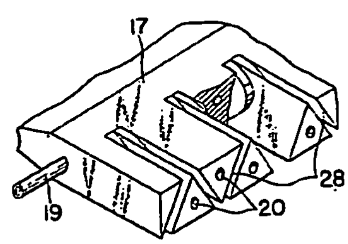


Fig. 12



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Sheets 1 & 2

Fig. 1

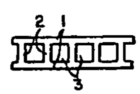


Fig. 2

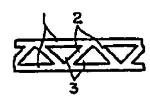


Fig. 3

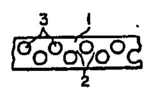


Fig. 4

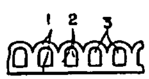


Fig. 5

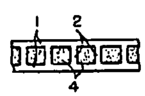
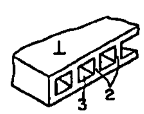


Fig. 6



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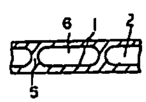

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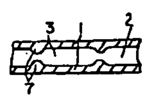


Fig. 9

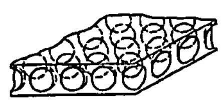


Fig. 10

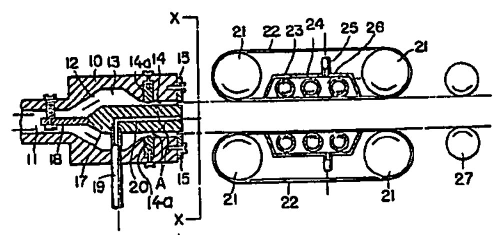


Fig. 11

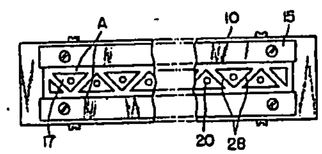


Fig. 12

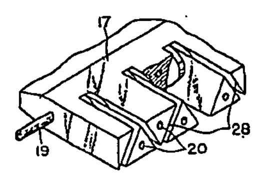


Fig. 13

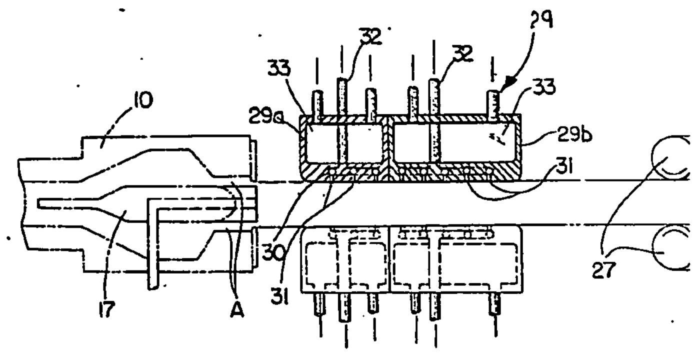


Fig. 14

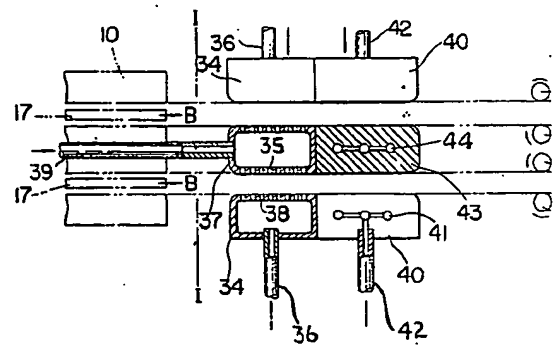
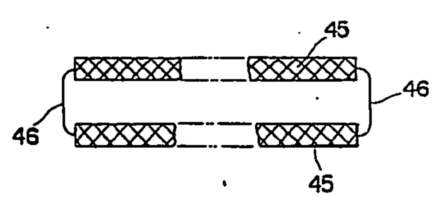


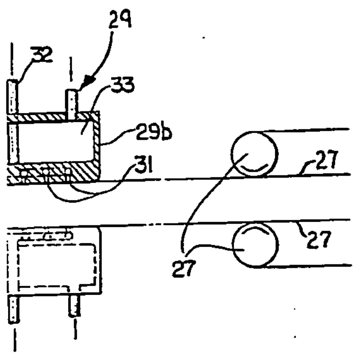
Fig. 15

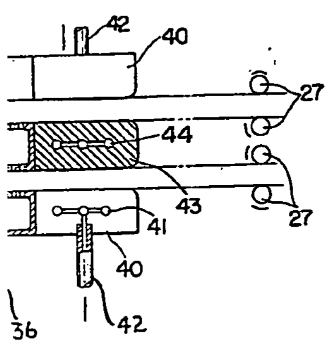


1042732 COMPLETE SPECIFICATION

4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheets 3 & 4





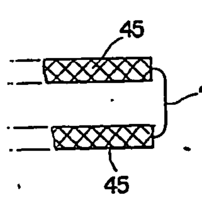


Fig. 16

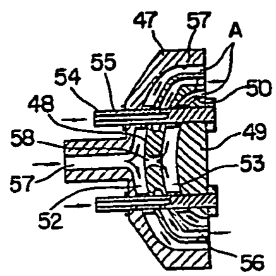


Fig. 17

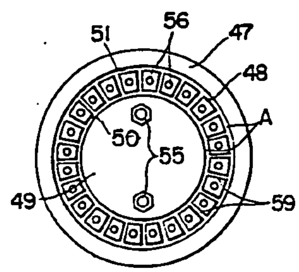
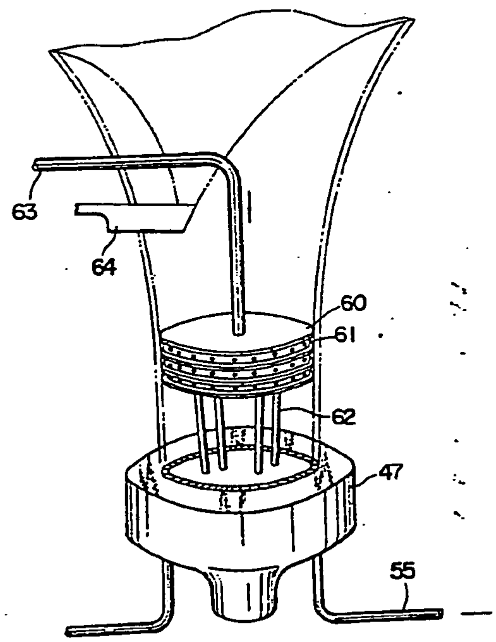


Fig. 18



1042732 COMPLETE SPECIFICATION

4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheets 3 & 4

Fig. 13

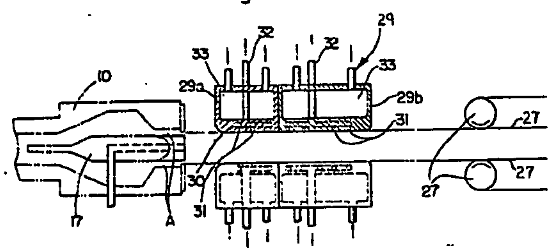


Fig. 16

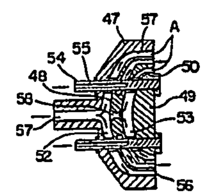


Fig. 17

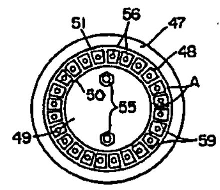


Fig. 14

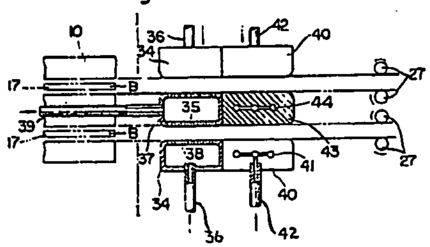


Fig. 15

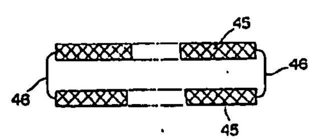


Fig. 18